



NNL Measurements at the RPI LINAC

November 07, 2018

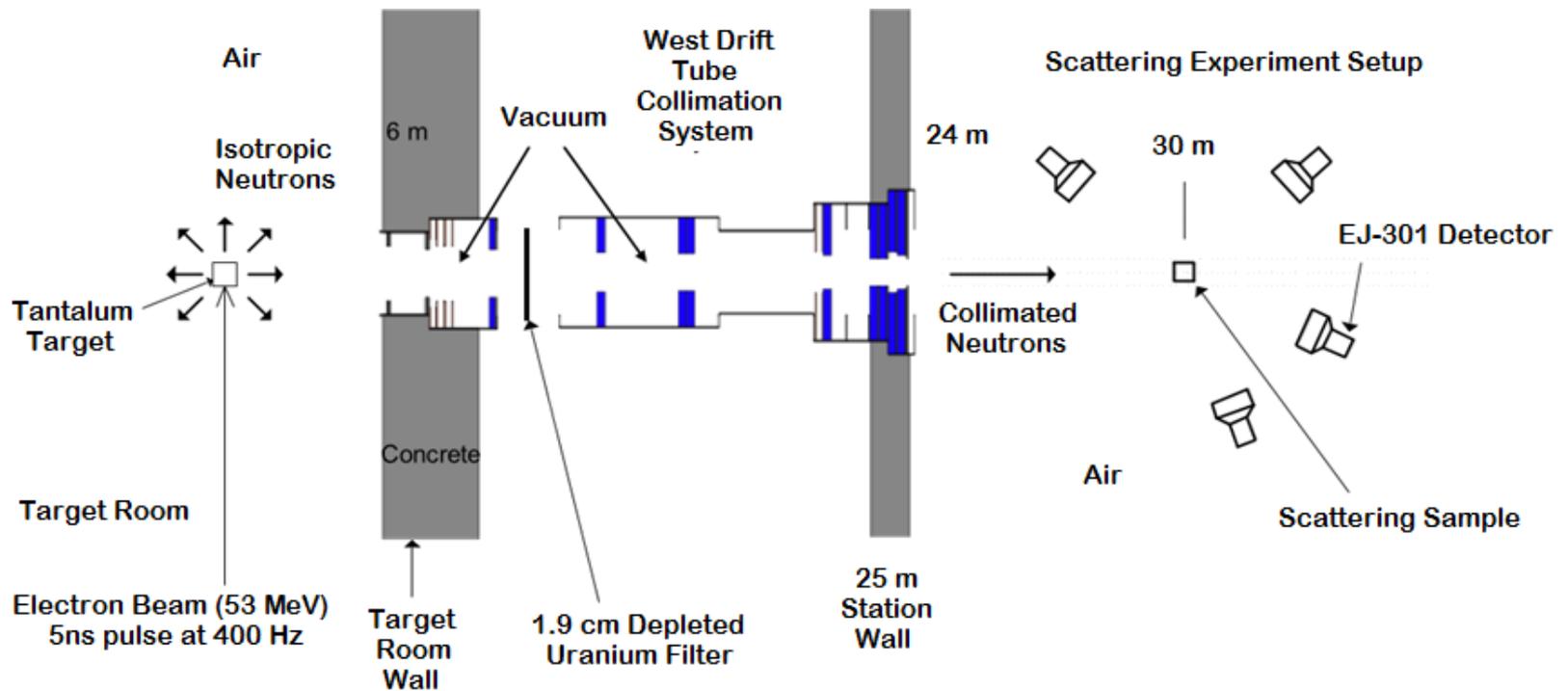
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Copper scattering experiments were recently performed

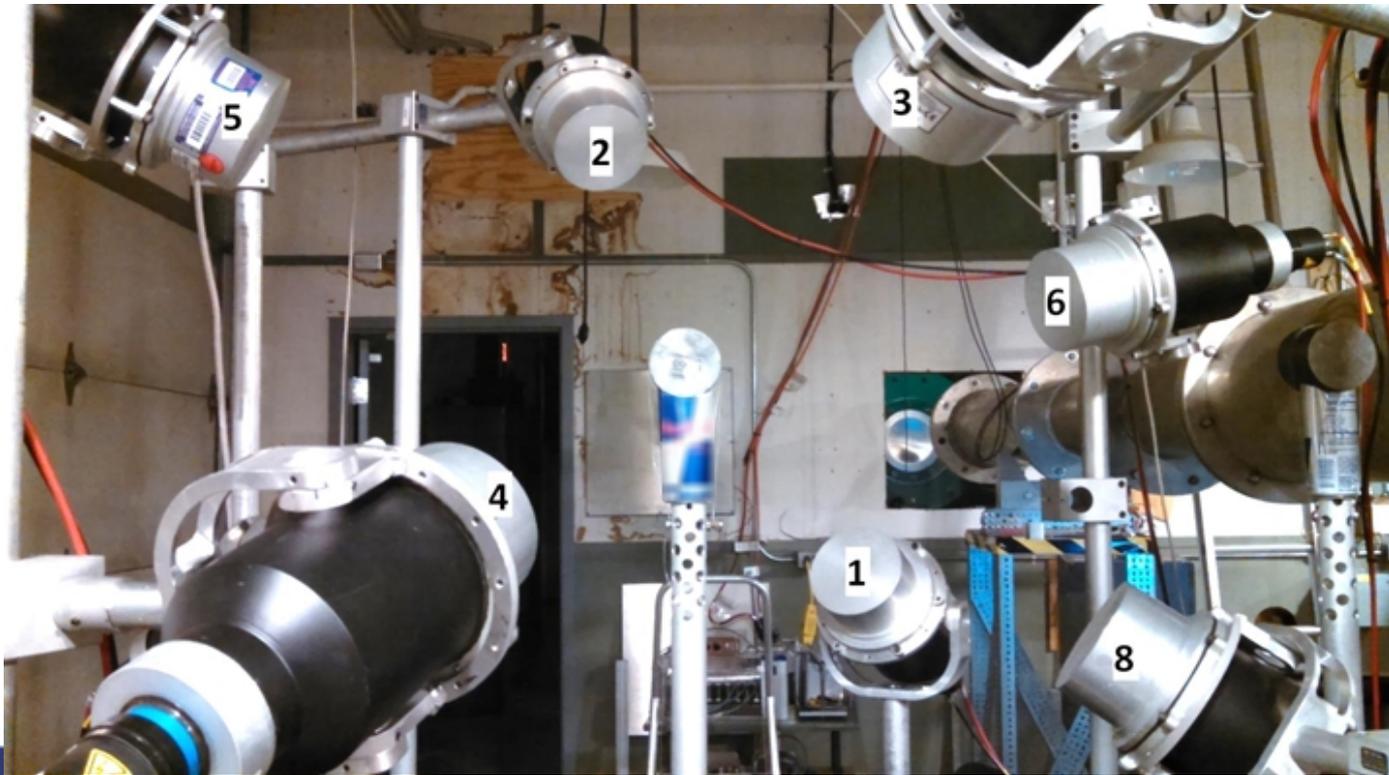
- Results are **preliminary** and subject to change
- Will be used to “benchmark” the current copper nuclear data libraries (ENDF-8.0, etc.)
- 3 cm natural copper sample
 - Two weeks with two different sets of angles
 - Week 1 angles: 26, 52, 90, 119, 154 degrees
 - Week 2 angles: 31, 73, 107, 140, 155 degrees
- 7 cm graphite sample used as reference
 - Historically well behaved data
 - If graphite data are good, then we trust copper results

Neutrons scatter from a sample and are measured by various detectors



Continuous energy and well-collimated neutron beam is used

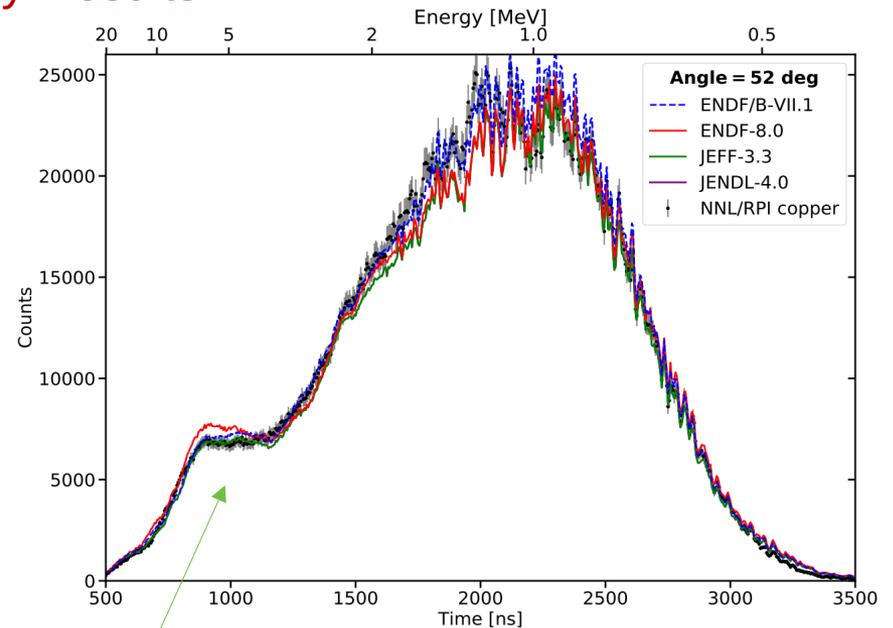
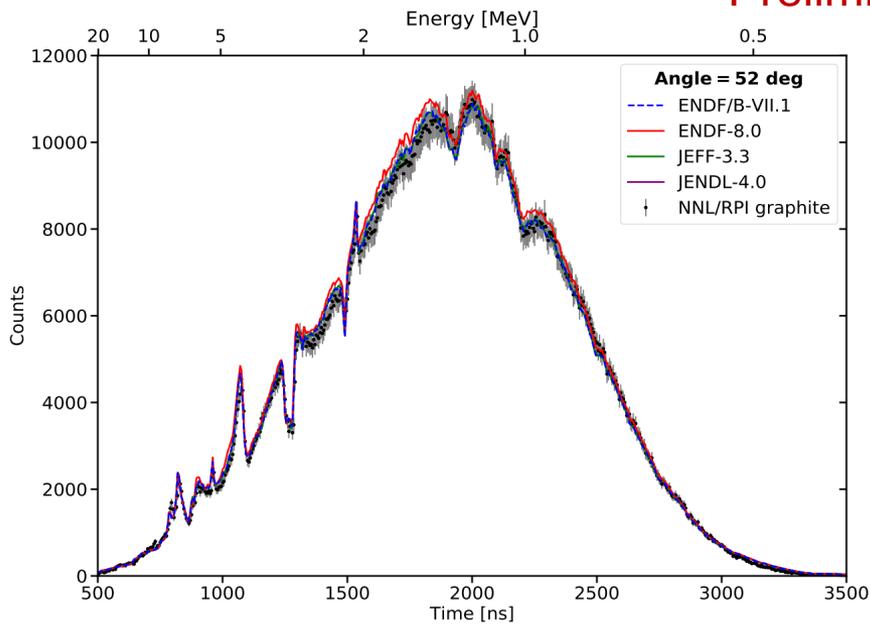
Eight detectors were placed at specific angles around the sample



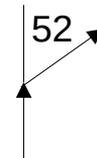
Neutron beam into the page

ENDF-8.0 copper looks reasonable at forward angles and lower energy

Preliminary Results

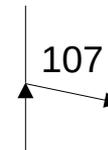
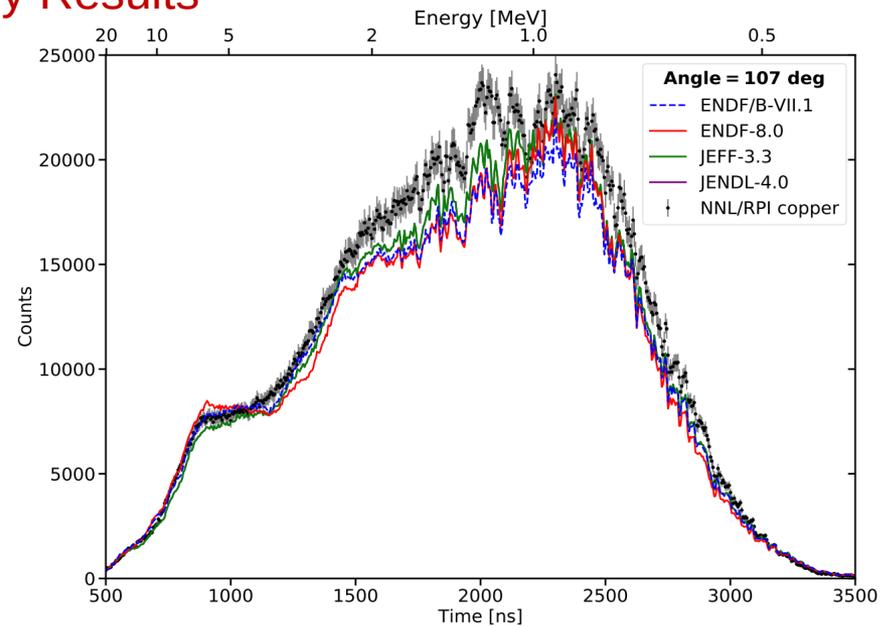
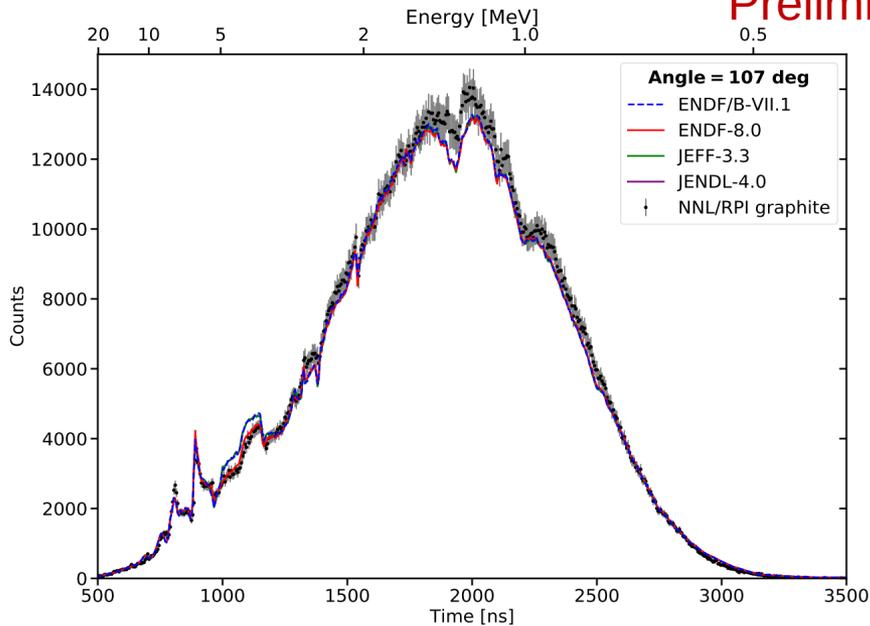


Mismatch at higher energy



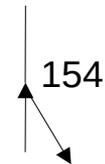
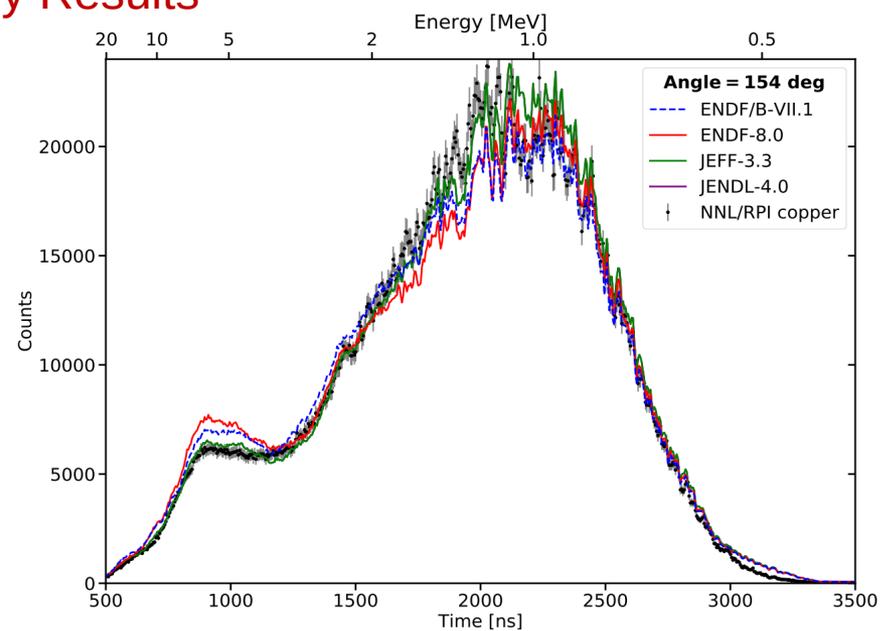
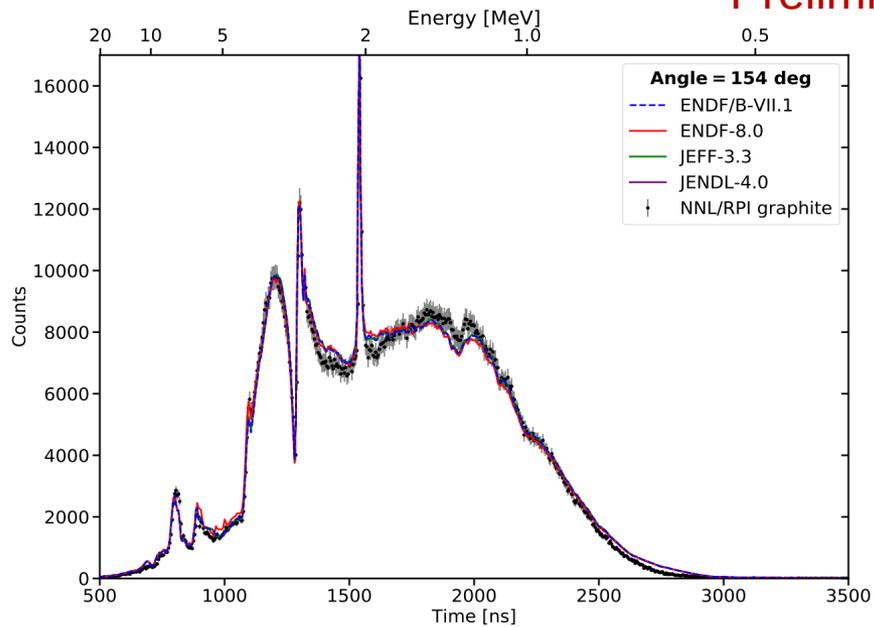
ENDF-8.0 copper has noticeable difference at side angles

Preliminary Results



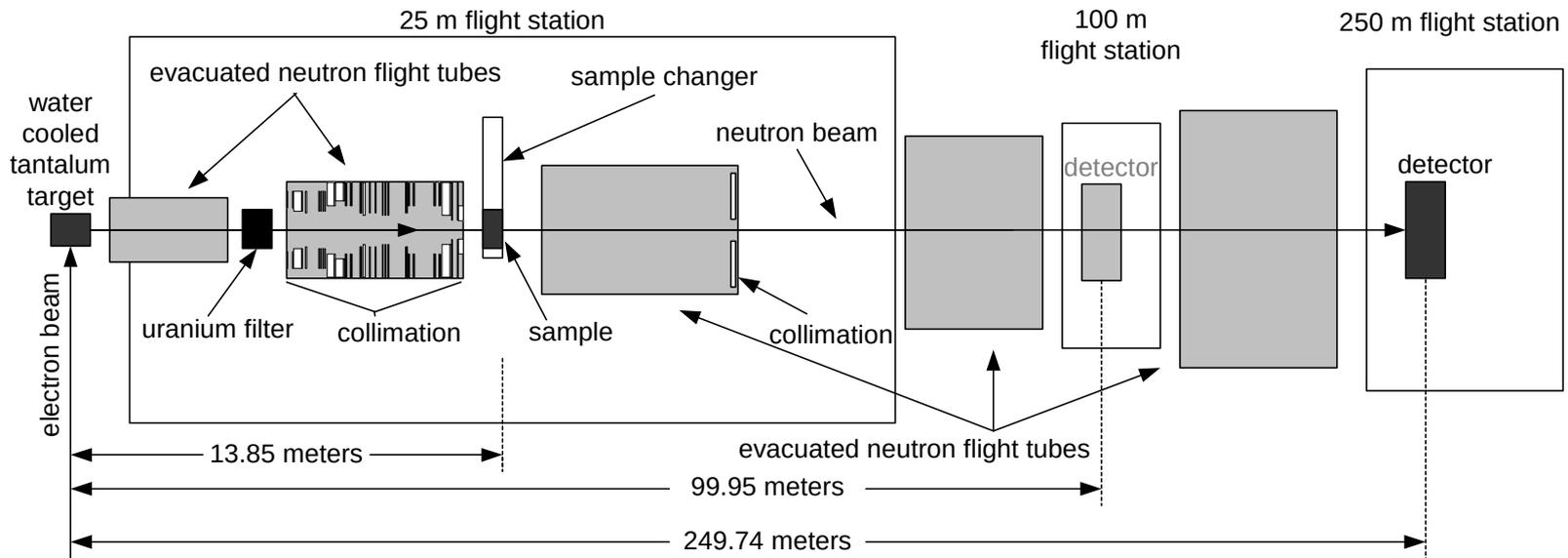
ENDF-8.0 copper has noticeable difference at back angles

Preliminary Results



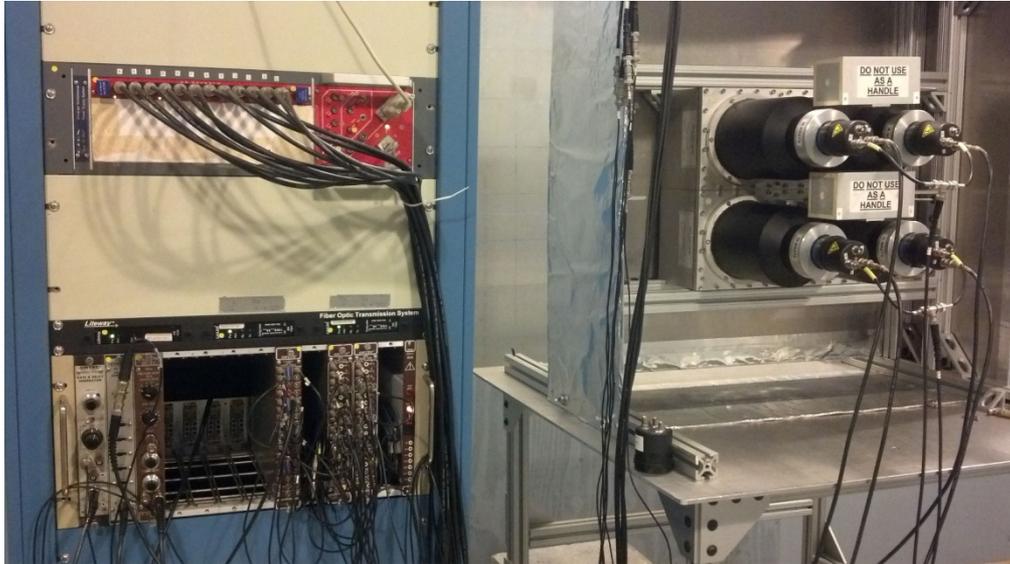
Hf High Energy Transmission

- Results are **preliminary** and subject to change
- Large area, modular, liquid scintillation detector
 - Located at 250 meter time-of-flight station
 - High-resolution
 - Long flight path, narrow neutron burst width, fast detector and electronics
 - High-accuracy transmission measurements (<1% - ~3%)
 - Excellent counting rate, good signal-to-noise
 - Measurement range of <0.5 to >20 MeV

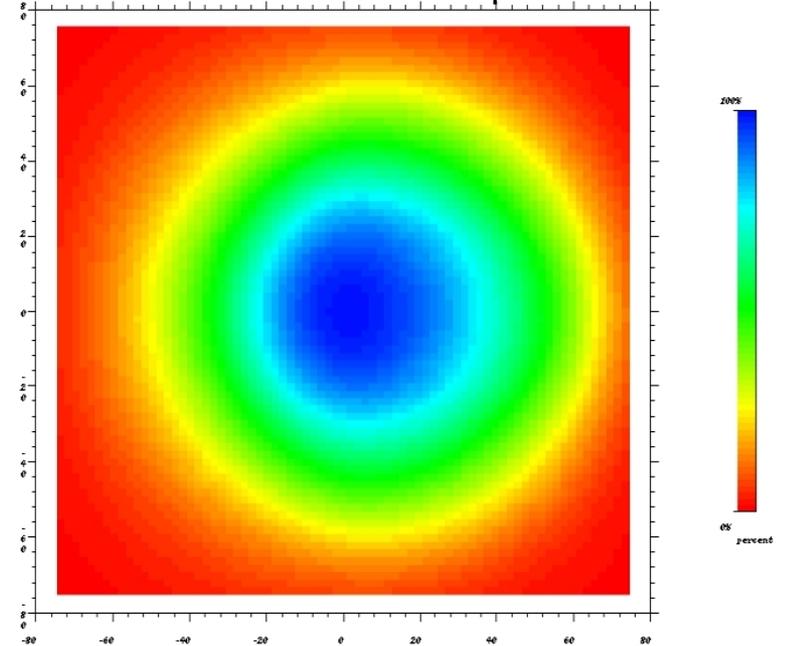


Hf High Energy Transmission

HiE Detectors and associated electronics



MCNP calculation of beam profile

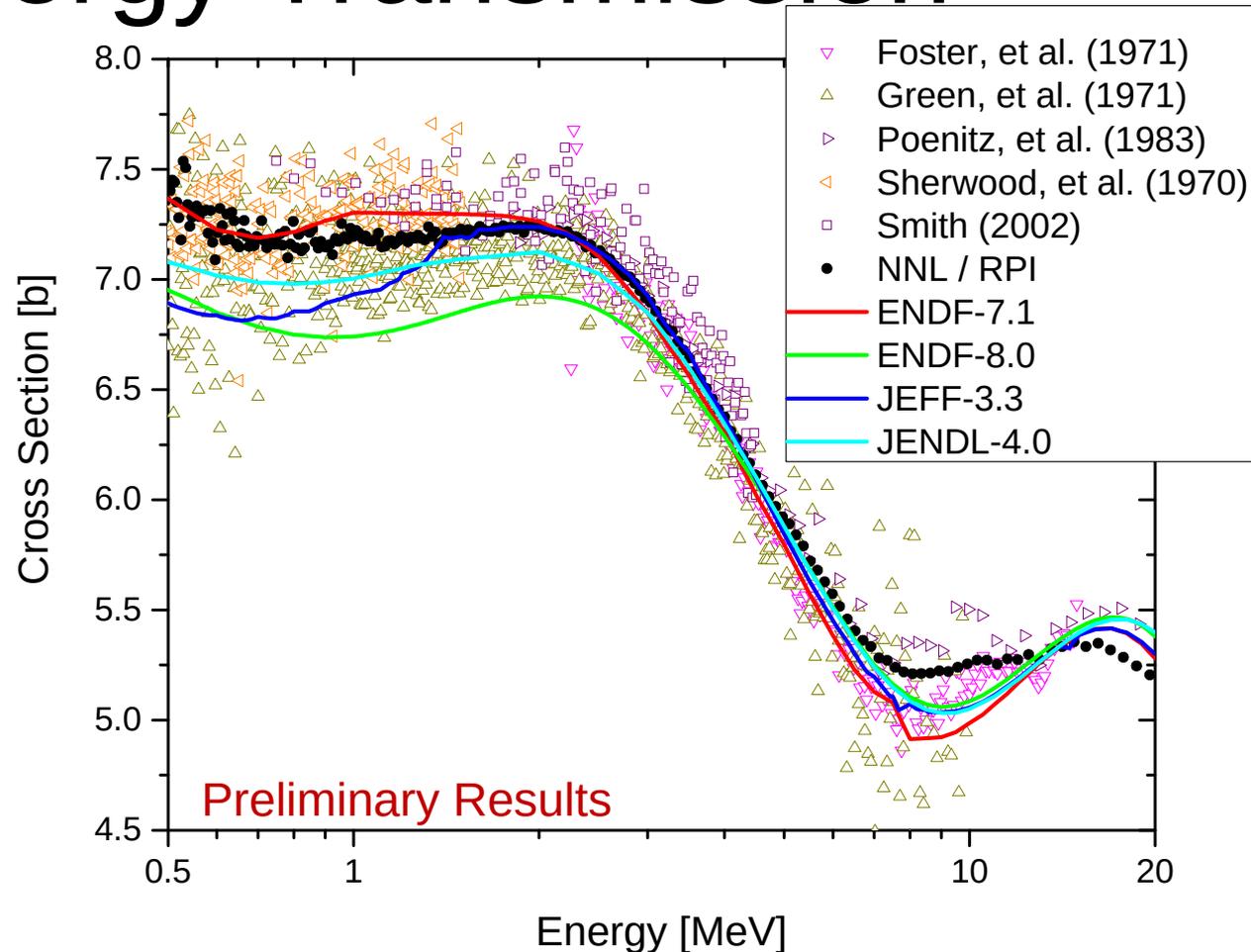


Hafnium samples



Hf High Energy Transmission

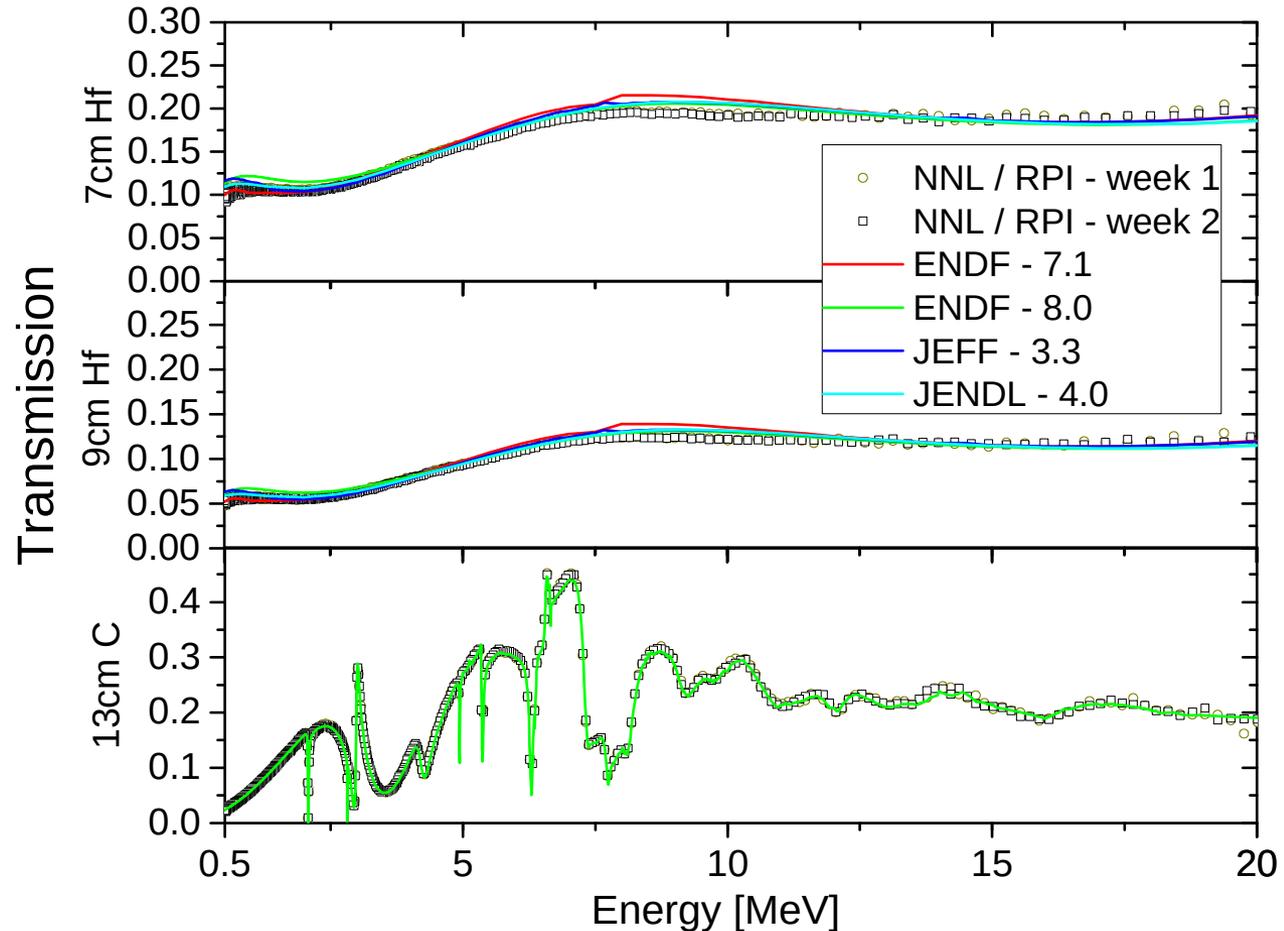
- Two samples
 - 9 cm thick
 - 7cm thick
- 13cm C reference sample
- Data taken over two week period
 - Week 1 ~50 hours
 - Week 2 ~75 hours
- Coincident with Cu HiE Scattering
- URR ends
 - ENDF-7.1: 50 keV
 - ENDF-8.0: 50 keV
 - JEFF-3.3: 88-133 keV
 - JENDL-4.0: 100-500 keV



Hf High Energy Transmission

Preliminary Results

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Conclusions

Preliminary Results show:

- Noticeable differences in side and back angle high energy scattering for copper ENDF-8.0
- Significant difference in high energy transmission for hafnium ENDF-8.0